Application of lean concepts to improve consumable disbursement process to reduce waiting time in a public hospital in Bangkok

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Abstract

The purpose of this research is to apply Lean concepts to improve the consumable disbursement process, in order to reduce waiting time at a public hospital in Bangkok. Data on the waiting time before process improvement was collected from July to September 2022 and found that the average waiting time was 9.67 days, which was slower than the standard set at 7 days. Analyzing the problem of delay in material retrieval and distribution using the 5W1H technique, fishbone diagram, and process map, it was found that the problem was due to a multi-step and repetitive work process, as well as incomplete documentation of the consumable disbursement. In addition, there were problems with storage locations and personnel. To improve the work process, the ECRS technique was used to eliminate unnecessary steps, reorganize the workflow, and improve the storage location for easier data retrieval. After process improvement in November-December 2022 and January 2023, the average waiting time was found to be 6.67 days, reducing waiting time for consumable disbursement retrieval by 3 days faster than the standard set. The results of this research can be expanded to other units within the hospital, especially in processes that are directly related to or require coordination with patients.

Keywords: lean concept, process improvement, consumable supplies requisition

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Introduction

The hospital has a primary mission to provide diagnosis and treatment services to patients, providing medical, nursing, and public health services to promote health, prevent diseases or conditions that increase the risk of disease, and rehabilitate patients after illness. In carrying out these operations, various departments within the hospital play important roles in driving operations to achieve the mission that has been set. The improvement of hospital operations has resulted in an enhancement of service quality, which was considered a significant variable in decision-making when choosing to utilize hospital services (Someran, Supaphol, Phantuptim, & Khaowisade, 2018).

A procurement unit of a public hospital in Bangkok was established in 2013 to support the operations of various departments within the hospital. Its responsibility is to procure consumables for the departments to use in their day-to-day work, such as pens, A4 papers, post-it notes, staplers, and document books, among others. Additionally, the department also procures cleaning supplies, such as laundry detergent, bathroom cleaners, air fresheners, brooms, and mops. The procurement department also oversees the estimated usage of supplies for each department in the hospital on a monthly basis, and each department is allowed to request supplies once per month. The initial process of consumables disbursement involved manual systems, which resulted in problems such as document loss, document errors in disbursement, as well as issues with inventory checking and stocktaking. This caused delays in the delivery of goods to service-receiving units. In 2017, the procurement group introduced an information system to increase work efficiency, and in 2021, a new information system was implemented. Both the various departments and the procurement unit are now able to easily process disbursement and check inventory through the information system. However, despite the use of the information system, approval by superiors is still required, with the Deputy Hospital Director being the final approving authority. This has resulted in document losses and delays, with some requisitions taking up to 17 days, causing shortages in consumable issues in the relationship between service providers and receivers, who must wait for the consumable disbursement process. Therefore, it is necessary to improve the process of consumable disbursement to reduce waiting time.

The procurement department is one such important unit, as research by Wongsa-harn (2016) found that if the procurement function is not appropriately managed, it may result in several risks, such as lost or damaged goods, deteriorated equipment that cannot be used,

and reimbursement claims for procurement, among others. These risks affect the overall functioning of the organization. Conversely, research by Dechsuwan, Wattanawarakul, Lateh, & Suwanmanee (2014) showed that if procurement is efficiently managed, it will result in efficient and high-quality patient care services. Therefore, in managing procurement to support hospital activities and operations to achieve goals, it is important to focus on efficiency and reducing various errors. The reduction in waiting time can be achieved by applying the lean concept (Womack, & Jones, 1997; Hines, Holweg, M., & Rich, 2004; Kovacevic, Jovicic, Djapan, & Zivanovic-Macuzic, 2015). The study by Chimwong, Nilsu, & Watanachokul (2013) applied the lean concept to improve the quality of diabetes patient care, focusing on reducing waste in the work process. This resulted in a reduction in waiting time, allowing nurses to have enough time to provide quality care to patients. Meanwhile, the research by Rattanapan, & Peerapattana (2016) improved service delivery and queue management in a dental clinic by applying the ECRS technique, which involved eliminating unnecessary steps, reorganizing the work process, and improving equipment for ease of use. This resulted in a reduction in waiting time by 50.69%, enabling the clinic to serve a larger number of patients.

From the current situation of waiting time for disbursement and the benefits of using lean thinking to improve work processes to be more efficient, it is necessary to study the improvement of the consumable disbursement process using lean thinking. The aims are to reduce the time for disbursement, improve the procurement unit to be more efficient, and create satisfaction for various departments in the hospital.

Research objective

To apply the Lean concepts to improve the process of consumables disbursement and reduce waiting time at a public hospital in Bangkok.

Literature reviews

Lean is a holistic and sustainable approach that aims to use fewer resources but achieve greater results while meeting customer needs to the fullest (Kumar, Luthra, Govindan, Kumar, & Haleem, 2016). The reduced waste associated with time, labor, tools, and work processes, is a key feature of Lean, which emphasizes the transformation from waste to value in the eyes of those who benefit from the work. Continuous improvement and change are the focus, utilizing concepts, activities, and methods that help to drive organizational culture in the right direction, through the development of good work ethics at all levels. The application of Lean thinking to work processes helps to develop business process improvement that

links value chains and adds value to products and services, creating a competitive advantage. Successful implementation of Lean thinking requires the involvement of both management and employees, working together to drive and support problem-solving initiatives. The Lean concept is based on the Toyota Production System, which emphasizes on the flow of work without losses or waste.

The five important principles of Lean, as stated by Gündüz (2015) are: 1) identifying the value of goods or services to satisfy customer preferences and expectations; 2) identifying the value stream to create value in the product or service; 3) implementing continuous flow processes to eliminate waste; 4) using a pull system based on customer demand to balance production and sales, where customers determine the amount of goods produced, as opposed to a push system which has been used for a long time; and 5) striving for continuous improvement to achieve excellence and competitive advantage. Applying the Lean concept can help improve work processes by reducing work time, waiting time, and increasing efficiency, as demonstrated by the works of Sunder, Rahul, & Marathe (2019) who illustrate the application of Lean concepts in consumer banking in real-time setting and found evidence of the successful application of LSS in consumer banking and the associated multiple benefits. Lean technique has been successful in implementation for improving in manufacturing and service sectors, especially in the case of consumer banks, which deal with high volumes of data, customer bases, and associated financial transactions.

The important technique for reducing waste is the ECRS technique, which consists of the principles of Eliminate, Combine, Rearrange, and Simplify. In summary, ECRS is the process of cutting unnecessary steps, combining redundant steps to save time and labor, adjusting the process by rearranging tasks to make them more appropriate, and improving the new work process to make it easier. It may involve creating tools or equipment to make the work easier. The ECRS technique can be used to reduce waste, as demonstrated by research on applying the technique to balance production lines and reduce waste in the packaging process of roasted peanuts (Kittiyankajon, 2022). It was found that the packaging process had wasted time from the step of filling the beans into the bags, which was the highest time-consuming step, and the main cause was the lack of standards in the work process. Therefore, the process was improved by balancing the production lines, rearranging the work, combining work together, eliminating unnecessary work, and making the work easier,

which resulted in a 26% reduction in waste time during the step of packaging roasted peanuts. Additionally, the production capacity increased by 60 bags per day. This research study has introduced the idea of Lean into the study for process improvement to reduce waiting time for the hospital's disbursement process.

Lean principles boost operational processes efficiency by utilizing diverse quality tools. These tools such as 5W1H analysis, process flowcharts, and fishbone diagrams, are exemplified by the investigation conducted by Paillin, Camerling, & Nasarany (2020) on minimizing time wastage during the stripping process. The study identified four specific types of waste out of the total seven, namely transportation waste, unnecessary inventory waste, defects waste, and waiting time waste. Among these, waiting time waste emerged as a critical issue, accounting for 29.8% based on questionnaire responses. The causes behind this waste were identified as inattentive parking, insufficient focus on stock/targets, limited space, lack of discipline, and negligence. Following the implementation of waste reduction measures, the lead time decreased to 1,550 minutes, resulting in an overall activity efficiency of 42%. Hence, these tools were employed in the aforementioned research study.

Methodology

This research is action research and the research process includes the following steps:

1. Study the duration of the consumables disbursement process by collecting data from consumables disbursement records and complaint logs for a period of 3 months, from July to September 2022. The data covered the following details: the list of individuals responsible for the disbursement, the requesting units or departments, the material identification codes, the item descriptions, and quantities requested for disbursement, the dates of each step of the process, and the personnel involved in each step of the consumable disbursement.

2. Analyze the problem of delays and find solutions by applying the 5W1H analysis, process flowcharts, and fishbone diagrams to identify the causes of the problem by mobilizing the internal workforce of the procurement unit. The team included the head of the procurement unit, deputy head of the procurement unit, inventory control registrar, warehouse manager, deputy warehouse manager, procurement officer, administrative staff, warehouse staff, and inventory control staff, totaling 16 people. They then brainstormed together to find solutions to address the root causes of the problem that occurred.

3. Based on the analysis of the problem of delays in material wastage disbursement, it was found that the issue was related to the work process, disbursement documents, personnel, and the arrangement of consumables. Therefore, in order to address the issue of delays, the researchers focused not only on establishing a new sequence of processes but also on addressing the aforementioned problems. Thus, the researchers applied the ECRS techniques, which could help alleviate the delays. The researchers applied ECRS techniques to improve the process by addressing the analyzed problems and following the four principles, namely 1) eliminating unnecessary work steps, 2) combining work processes, 3) arranging tasks in a suitable sequence, and 4) improving the work environment to facilitate operations.

4. Study the period of consumables disposal after the process improvement by collecting data from consumables withdrawal and complaint records over a period of 3 months from November to December 2022 and January 2023.

Results

The research findings revealed that the disposal time for consumables during the period of July-September 2022 was slower than the agreed-upon standard of 7 working days, which was established collectively by the hospital staff, as indicated in (Table 1).

Table 1 The duration of consumables disbursement before process improvement.

month	average duration of consumables disbursement (days)	the results of consumables disbursement compared to the standard criteria		
		fast	normal	delay
July	9			✓
August	11			✓
September	9			✓
average	9.67			✓

The researcher used the 5W1H technique to investigate the cause of the delay in the consumables disbursement and the results are shown in (Table 2).

The problem of delay arises from the process of consumables disbursement according to various steps, which require approval and signatures from the heads of each unit in accordance with the chain of command. Additionally, there are internal problems within the procurement unit itself. The cause is from the work process, especially the route of documents that need to be signed for

approval of disbursement according to the workflow, and there are redundant steps. In addition, the loss of documents during the approval process according to the workflow, coupled with incomplete documents, results in having to send the documents back for correction, causing the consumables disbursement process to take longer than it should (Figure 1).

Table 2 The result of brainstorming to find the cause of the delay in the consumables disbursement.

5W1H	answer for 5W1H
who is responsible?	procurement unit team
what is the problem?	delayed disposal of consumables due to redundant work processes
where did the problem occur?	procurement unit
when did the problem occur?	in the past six months
why did the problem occur?	there have been requests for consumable items from other units, which were sent through the appropriate channels but took a long time to be signed off on, resulting in redundant work and delays in fulfilling requests
how was the material waste disbursed?	1. the unit handles requests for materials and sends them through the information system 2. the Procurement team inspects and checks the documents for procurement and disposal 3. they organize the items according to the request form submitted by the unit and check for accuracy 4. they notify the unit to come and pick up the requested items

The delay is also caused by the storage place, which resulted from the lack of design of the space, the arrangement of materials in order, and the failure to classify the materials, causing time loss in organizing the items. In addition, the delay is also caused by the personnel who lack coordination and understanding of the work process. Moreover, there is unnecessary paperwork and redundant processes for cutting materials, both manually and through information systems. The redundancy of the material checking process is also due to a lack of communication among the warehouse staff, resulting in wasted time. The delay in the consumable disbursement is also due to the relatively long process of requesting approval for procurement and distribution along the workflow. Sometimes, the consumables disbursement process takes up to 17 days because it is necessary to wait for the department head to sign off before submitting the request to the procurement unit.

In terms of personnel, the problem of delays is caused by employees lacking knowledge and skills in using information systems. Working through the information system has not been able to reduce the time of consumables disbursement as much as it should. In addition, employees also lack knowledge and understanding of the procurement and disbursement system. Data shows that there are documents sent to the wrong department, documents with errors sent to the procurement unit, and documents proposed by departments but not received by the procurement unit, due to documents getting lost during the approval process. Furthermore, the cause of delays also stems from the storage of materials, where there is a lack of proper organization and distribution, resulting in a lack of agility in work processes and time wasted in organizing materials according to requisition forms. The problem of delays in consumables disbursement has an indirect impact on the hospital's internal operations and also affects the quality of patient services.

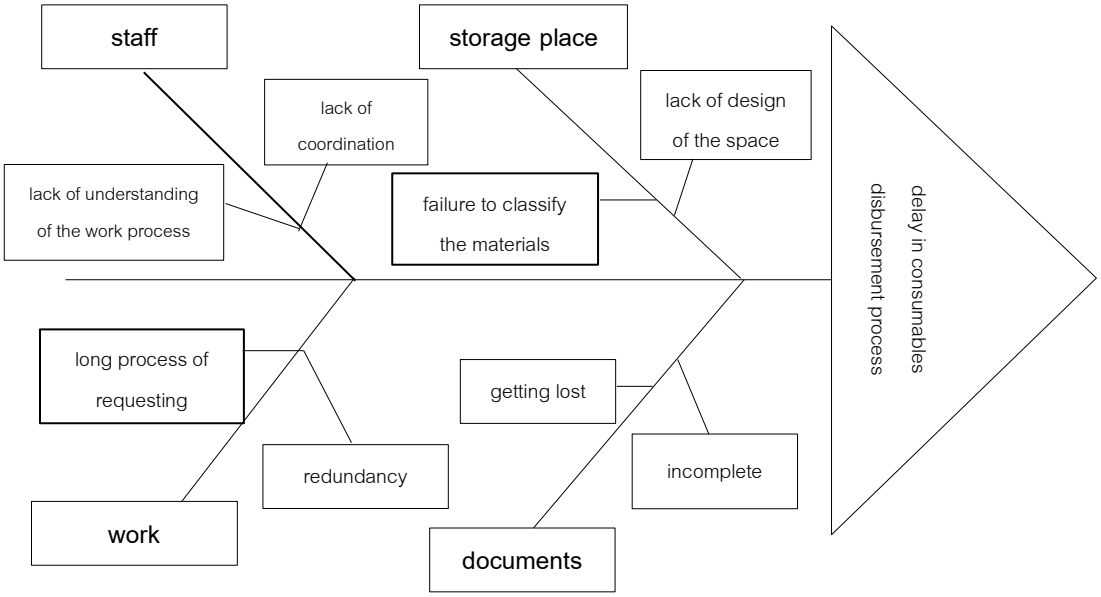
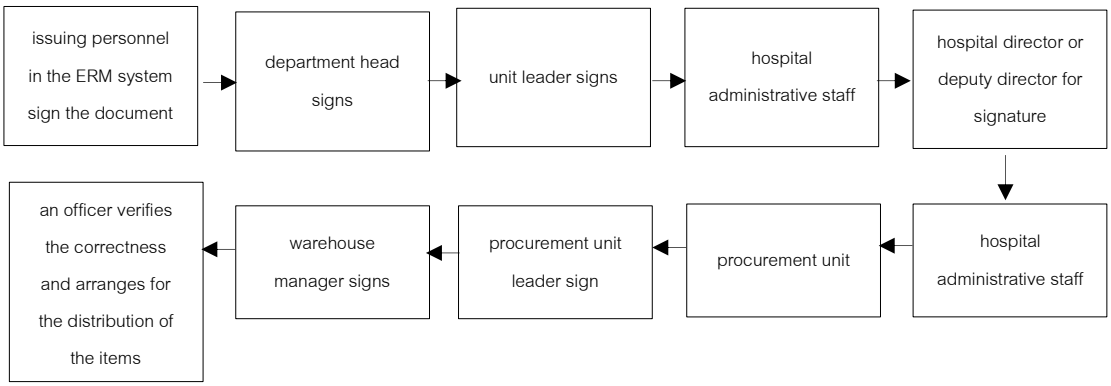


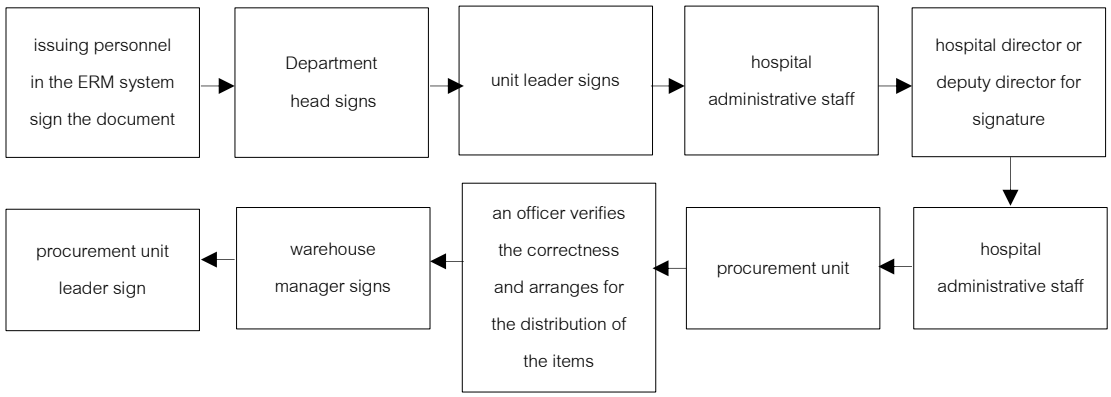
Figure 1 The causes of the delay in the consumables disbursement process.

From the analyzed problems and their causes, the researchers have made process adjustments using the ECRS technique to solve the problem. The focus is on reducing waste in the work process by eliminating unnecessary steps in manual work processes and the slow process of cutting consumables through the information system due to the overlapping of the

use of manual systems and the material cutting process through the information system. Therefore, the work process has been modified by reducing the manual consumables cutting process and combining work processes. The researcher has also combined the consumables checking process with one employee instead of multiple checks within the unit itself, which resulted in redundant work and increased material delivery time. Furthermore, the researcher has improved the document retrieval process by reordering the tasks, as shown in (Figure 2).



The document's routing before the process has been adjusted.



The document's routing after the process has been adjusted.

Figure 2 Adjusting the work process of consumables disbursement.

The researchers have reorganized the workflow by adjusting the travel of documents for consumables disbursement according to the job sequence that requires the approval and

signature of the procurement unit head. Previously, the process was ranked 8th, and waiting for department heads to approve had a significant impact on the waiting time for consumables disbursement documents. Therefore, the researcher has prioritized the travel of documents by changing the approval process of the procurement unit head to rank 10.

Furthermore, the researchers have improved the interior of the warehouse by categorizing consumables and working in separate rooms for different types, such as a cleaning materials room, office supplies room, and general materials room. Additionally, they have organized the placement of consumables in each room to be easily movable and adjusted the pathways to provide convenient working space. In terms of personnel, the procurement unit has provided training to hospital staffs to increase their understanding and minimize errors in document processing or misdirected documents. They have also solved problems caused by internal personnel by rotating work, allowing staff to substitute for each other to prevent delays or accidents that prevent work. The results of the new work process have reduced the time for material requisition and payment and met the established criteria, as shown in (Table 3).

Table 3 The duration of consumables disbursement after process improvement.

month	average duration of consumables disbursement (days)	the results of consumables disbursement compared to the standard criteria		
		fast	normal	delay
November	7		✓	
December	7		✓	
January	6	✓		
average	6.67	✓		

From (Table 3), it can be seen that the time for consumables disbursement after the process improvement in November-December 2022 and January 2023 was 6.67 days, which is 3 days faster than before the process improvement and faster than the established standard.

Discussion

The results of this research demonstrate that Lean concepts can be applied to improve the consumables disbursement process and help reduce the waiting time for the delivery of hospital supplies. This is consistent with the research findings of Chimwong, Nilsu, & Watanachokul

(2013), who applied Lean concepts and ECRS techniques to improve the quality of care for diabetic patients in a diabetes clinic at a hospital in Rayong.

The study was able to reduce waste in the work process and reduce patient waiting times, in addition to being consistent with the research work of Kanoksirirujisaya, Srininpan, & Ratchabut (2022), who used ECRS techniques to reduce waste in the production process of hard disk drive head arms by eliminating unnecessary steps in the process, combining similar tasks together, and rearranging them to create a more balanced production line. In addition to this, this research also involved adjusting the space of the room or warehouse for consumable material storage, making it easier for staff to carry out their duties. This was a contributing factor in reducing the waiting time for the withdrawal and distribution of consumable materials. The findings of this research are consistent with the work of Arree, Chammuangpak, Saelim, & Sawisit (2020), which involved adjusting the storage space of goods, resulting in efficiency in storage and inventory counting, leading to the establishment of an efficient warehouse management policy.

This research reduced waste caused by overworking and reduced non-value-added work, resulting in fewer people and less time required to perform work, leading to increased work efficiency.

In addition, this research also reflects the benefits of using the 5W1H technique to search for problems with slow material waste procurement. It focuses on answering various questions related to the delay, with direct participation from relevant employees. The research results are similar to the work of Suhardi, Anisa, & Laksono (2019) which reduced waste in the production factory by improving the production process using the 5W1H technique and ECRS principles, which are basic tools of kaizen, allowing the factory to solve bottle-neck problems and reduce product waiting time by up to 4.79%.

Conclusion

The objective of this research was to apply Lean concepts to improve the process of consumables disbursement in order to reduce the waiting time for the use of consumables in a hospital unit. The study involved analyzing the duration of dispensing and wasting consumables, analyzing the problem of delays, and finding solutions by applying the 5W1H analysis, process flowcharts, and fishbone diagrams. Then, the brainstorming was used to identify the root causes of the problem before applying the ECRS technique to improve the consumables disbursement process. The results of the process improvement included eliminating unnecessary work steps, combining work processes, optimizing

work sequencing, and improving workspaces to reduce waiting times for consumables material delivery. In other words, before the process improvement, the average duration was 9.67 days, and after the process improvement, the duration of consumables disbursement was reduced by 31.02 percent to 6.67 days.

The results of this research show that lean concepts can be applied effectively to improve the efficiency of hospital consumables disbursement process management. Therefore, other hospitals can use the results of this research to adjust their consumables disbursement processes in various units to be more efficient. This should begin by studying the duration of procurement and analyzing the causes of the problem, using analysis techniques such as the 5W1H analysis, process flow charts, and fishbone diagrams, to comprehensively identify the root causes of the problem. Employees should be involved in providing information and brainstorming to consider the causes of the problem and solutions. After that, process adjustments should focus on eliminating unnecessary steps in the work process, combining work steps, arranging tasks appropriately, and upgrading facilities to make work easier.

Based on the research findings, it was found that the lean concept can be used to improve the process of waste material requisition, reduce the waiting time for requisitioning, and deliver better than before. Therefore, this concept should be expanded to other units within the hospital, particularly in processes that are directly related to or require coordination with patients, in order to reduce waiting time in various processes, eliminate waste, and create satisfaction for patients and their families who use the services.

This research highlights the effective application of lean concepts in improving the efficiency of hospital consumables disbursement process management. The findings suggest that the results of this research can be valuable to other public hospitals seeking to enhance the efficiency of their consumables disbursement processes in various units. However, in the case of public hospitals, with their unique set of challenges and constraints (Daultani, Chaudhuri, & Kumar, 2015), there may be limitations in implementing and benefiting from lean concepts based on the findings of this research. Nevertheless, by optimizing the consumables disbursement process, hospitals can not only improve operational efficiency but also enhance patient care and satisfaction. It is important to acknowledge that each hospital operates in a distinct context and may face specific challenges (D'Andreamatteo, Ianni, Lega, & Sargiacomo, 2015). Therefore, while the research findings provide a valuable starting point, customization

and adaptation to suit the specific needs of individual hospitals are essential. This may involve tailoring the proposed strategies, considering resource availability, staff expertise, and the specific requirements of the patient population served by the hospital.

This research has set the objective of improving the process by reducing waiting time for consumable wastage according to the specified standard. This is achieved by eliminating unnecessary work steps, combining work processes, optimizing work sequencing, and improving the internal warehouse space. As a result, the waiting time for material wastage has decreased in accordance with the established standard. However, this research has limitations as it has not analyzed the value-added (VA), non-value-added (NA) and non-value-added necessary (NNVA) aspects, which are the starting point for process improvement. Therefore, in the future, it is advisable to gather additional data to analyze these issues, which will make the research more comprehensive.

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